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First Annual Directory of Locomotive Repair Facilities

December 28, 1981

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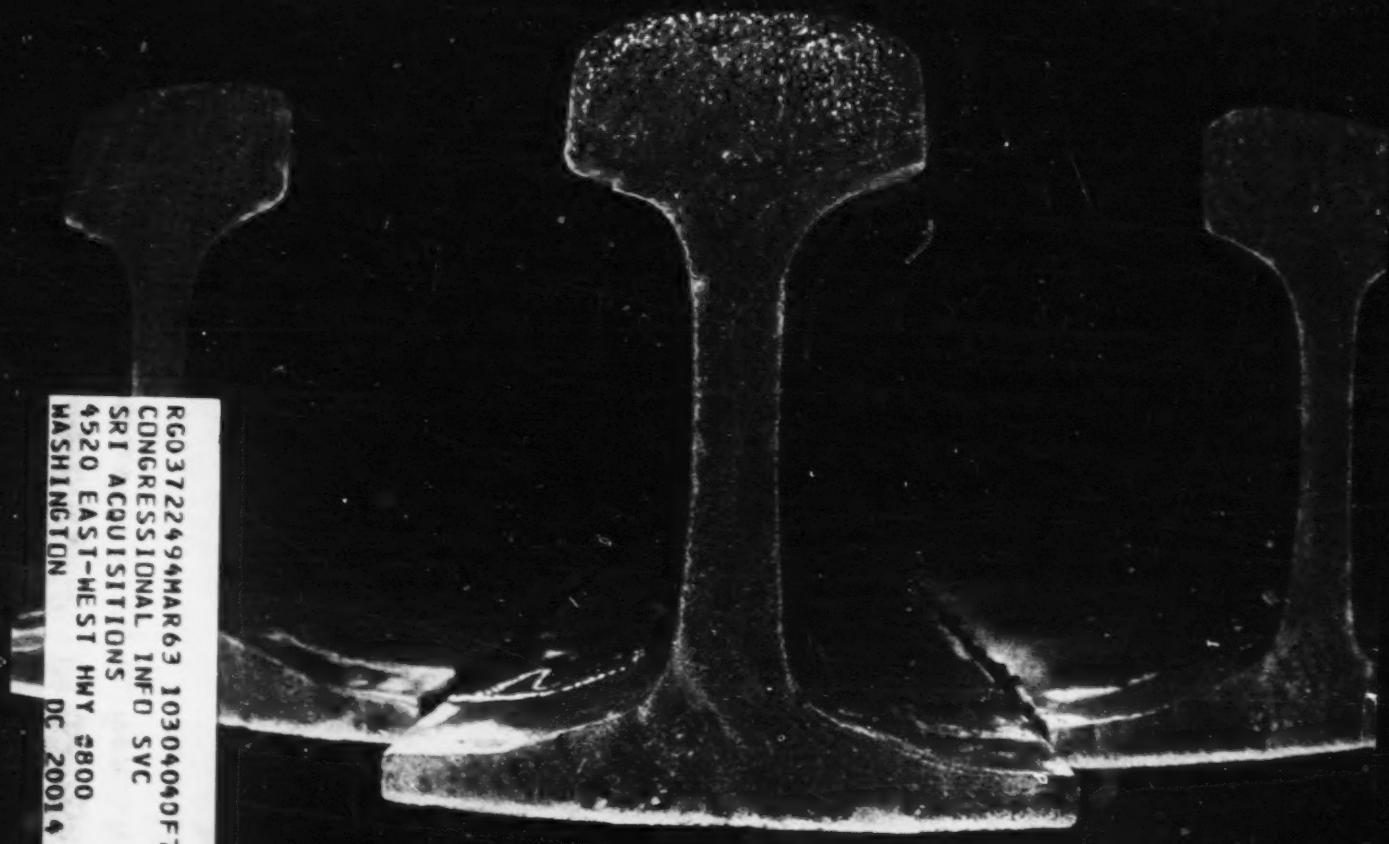

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Budget planning '82

RAILWAY AGE

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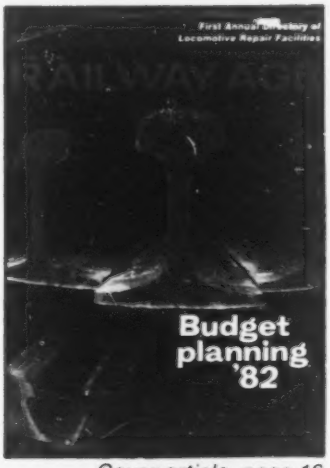

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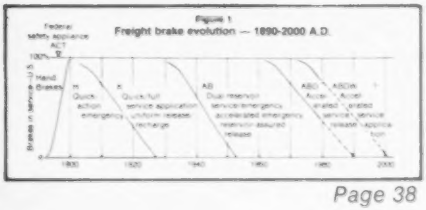

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COVER: Photo by Chessie Staff Photographer John B. Corns, Cleveland.

Budget planning '82

The emphasis

By GUS WELTY,
Senior Editor

If railroads follow through in 1982 with the budgets now established for capital improvements and maintenance, the industry will be in more-than-adequate shape to handle the traffic upturn that will come with the inevitable upturn in the economy.

With only a couple of exceptions, major roads will be increasing total capital expenditures over 1981 levels. With no exceptions at all, major roads with operating budgets set for '82 anticipate higher spending for both maintenance-of-equipment and maintenance-of-way-and-structures.

As in 1981, however, one area of expenditures will lag. Based on budget figures reported up to mid-December, equipment spending for most roads will be off, mainly because of the large numbers of freight cars and locomotives in storage, awaiting the return to duty that will come only as the economy improves and general-commodity traffic picks up.

When will that happen? Most forecasters are now saying after mid-year. Perhaps significantly, some analysts are looking for a sharp upturn, when it finally does come.

At that point, it's conceivable that equipment budgets could be quickly adjusted upward, though most roads are being cautious in talking now about what might happen to those budgets then.

One thing is certain: With most car-building plants operating well below capacity (if at all), lead-times on deliveries should be minimal, at least for those railroads first in line.

Capital Expenditures
(millions)

	1981	
	Total	Equipment
Burlington Northern	$346.0	$147.3
CN Rail	518.6	128.6
CP Rail	300.0	100.0
Conrail	370.0	60.0
CSX (Chessie System, Family Lines)	507.0	338.0
Missouri Pacific	290.0	195.0
Norfolk & Western	128.1	71.2
Santa Fe	272.0	161.0
Southern	300.0	172.0
Southern Pacific	200.0	60.0
Union Pacific	146.3	49.6

shifts from equipment to track

In the meantime, railroads will be spending heavily for improvements and additions to fixed plant and for maintenance of both plant and equipment. With only scattered exceptions, the rates of increase—especially for maintenance—are expected to outpace inflation, even if a 10% inflation rate is assumed for 1982 (and that's a high-side assumption, because most observers are looking for the rate to fall a point or two into single digits).

● **Patterns changing?** Historically, most railroad capital dollars have gone for equipment. But the budget numbers provided to *Railway Age* by major carriers for 1981-82 indicate that history is being rewritten.

What this will mean to equipment suppliers remains to be seen, because the market is not just cyclical—it can also be volatile, at both the low and the high points of the cycles. Cases in point:

—At its December forecast meeting, the American Railway Car Institute, looking back on a year in which only about 45,000 cars would be delivered, was looking ahead to a year that might see deliveries at plus-or-minus 35,000 units, based upon late-1981 order/backlog relationships and prospects for early-1982 orders. But the range of estimates for '82 deliveries ran from 30,000 to 50,000. For 1983, the spread was even greater. And for both years, with upwards of 20 suppliers putting forecasts onto the chart, the estimates of new-orders-placed hardly made a consensus. For example, new-order forecasts ran from 20,000 to 50,000 in 1982 and from 30,000 to more than 70,000 in '83.

—On locomotives, one late-1983 forecast saw only about 300 units being built in the United States in 1982 for domestic delivery. But when *Railway Age* asked the railroads for their 1982 locomotive-acquisition plans, just seven roads put the total higher than that, and these were the numbers: Missouri Pacific, 95 units; Southern, 64; Santa Fe, 55; Burlington Northern, 53; Norfolk & Western, 25; and Chessie System/Family Lines, 25.

—Meanwhile, back in the freight-car market, only three of the largest Class I roads were planning to acquire more than 1,000 freight cars in '82. And two, Chessie System and NW, are roads with substantial in-house car-building capability. This could indicate that, until signs of a traffic upturn become clearer and equipment begins to move out of storage, car-builders will be scrapping for what business there is, in an industry where annual production capacity is now estimated at about 120,000 cars.

● **Road by road.** What are the biggest of the U.S. roads planning for 1982?

—Like many other roads, Burlington Northern will be cutting equipment spending while fixed-plant spending rises. Overall, BN plans capital spending of $369 million in '82 (up from $346 in '81). Equipment expenditures of $114.2 million will include acquisition of 375 freight cars, 113 trilevel auto-racks and 619 trailers, along with 53 locomotives. Plant expenditures of $254.8 million will include $65.8 million for track and roadway improvements, $58.1 million for construction of additional track and $23.8 million for installation of signal and allied equipment.

—Conrail, at this point, has no plans for acquisition of freight cars or locomotives in '82, and the dollars in its equipment capital budget reflect lease buyouts of equipment already in service. Fixed-plant spending, adding up to about $330 million, will be concentrated on "improvements which will allow us to handle existing and projected traffic levels at reduced costs while maintaining and even improving service quality." What this means is that, now that core-system facilities have been rehabilitated, Conrail will be working on secondary and feeder lines with profitable traffic levels and/or growth potential: "Coal origin lines and lines to utility plants would be just one example. Coal-related facilities, particularly those involved in export shipments, are also being improved. Signaling changes are anticipated in order to reduce costs in light of traffic levels." Conrail is also planning for additional improvements in yards and terminals and on connecting tracks to improve operational efficiency.

—Chessie System and Family Lines will be down in total capital budget but up in fixed-plant spending, from $169 million this year to $211 million in 1982. Still, these CSX railroads will be acquiring 25 new locomotives and more than 2,400 freight cars. Significantly, Chessie and Family Line, already ranking first in spending for maintenance programs ($1.050 billion for M/E this year and $815 million for M/W&S) anticipate substantial increases next year, to $1.225 billion for M/E and $955 million for MW&S.

—For Missouri Pacific, total capital spending will go from $290 million to $352 million, with fixed-plant expenditures climbing from less than $100 million

Operating Expenses
(millions)

1982				1981		1982	
Fixed Plant	Total	Equipment	Fixed Plant	Maintenance/ Equipment	Maintenance/Way and Structures	Maintenance/ Equipment	Maintenance/Way and Structures
$198.7	$369.0	$114.2	$254.8	$881.1	$744.1	$965.3	$843.0
390.0	600.0	117.2	482.8	647.7	371.9	710.0	420.0
200.0	300.0 - 400.0	75.0	225.0 - 325.0	380.0	227.0	443.0	258.0
310.0	425.0	95.0	330.0	720.0	705.0	730.0	720.0
169.0	467.0	256.0	211.0	1,050.0	815.0	1,225.0	955.0
95.0	352.0	112.0	241.0	429.4	306.0	480.0	362.0
56.9	185.4	79.2	106.2	235.7	275.1	298.4	308.5
111.0	271.0	148.0	123.0	514.0	383.0	N.A.	N.A.
128.0	N.A.	90.0	N.A.	247.7	208.9	N.A.	N.A.
140.0	166.0	95.0	71.0	N.A.	N.A.	N.A.	N.A.
96.7	162.7	N.A.	N.A.	414.7	338.2	471.7	388.7

in 1981 to more than $240 million in 1982. Freight-car, auto-rack and trailer acquisitions will drop, but MoPac will still be the largest acquirer of new motive power among U.S. roads, with 95 units due to come into service. MoPac will begin work on a $40-million diesel shop at North Little Rock. It will also be working on a locomotive shop at Fort Worth, on expansion of its yard at Houston, and on passing-track and yard expansions and piggyback terminal expansions at a number of points. MoPac will be laying upwards of 500 miles of continuous welded rail, and it will be one of the industry's biggest '82 buyers of track-and-roadway machines.

—Norfolk & Western is one of the few roads to budget 1982 increases for both equipment and fixed-plant spending. There will be fewer cars, but more locomotives—25 in '82 compared with just five this year. Major fixed-plant expenditures will include more than $11.9 million for rail and ballast work; $8.6 million for construction of new intermodal facilities at Landers Yard, Chicago; $3.6 million for installation of hydraulic retarders to replace inert retarders at Bellevue (Ohio) Yard; and more than $3 million system-wide for acquisition of shop and storehouse machines.

—For Santa Fe, capital spending will hold about even with 1981 levels, but with somewhat more emphasis on fixed-plant projects. Included in Santa Fe's $123 million program for property improvements and additions will be installation of 176 miles of new rail and 192 miles of relay rail; siding extensions and bridge improvements; signal improvements on 273 miles of line; purchase of 122 pieces of track/roadway equipment; expansion of intermodal facilities at six locations; and the start of multi-year projects to relocate diesel facilities at Argentine Yard (Kansas City) and at Barstow, Calif., Yard.

—Southern has announced orders for locomotives and freight cars and trailers which add up to $90 million, all for delivery in first-half '82. Southern's equipment spending this year was a little less than twice that, $172 million. Southern plans to lay 250 miles of new rail in 1982, replace 1.5 million ties, and buy $4 million worth of new track machines.

—Southern Pacific is perhaps the one capital-budgeter that marches to another drummer, with capital expenditures for equipment up and spending for fixed plant down. SP's planned total for '82: $166 million, of which $95 million will be for equipment (up from $60 million in 1981).

—With equipment plans currently on "hold," Union Pacific is still figuring on an increase in total capital expenditures, from about $146 million this year to more than $162 million next year. Included will be more than $40 million for capitalized rail/track improvements and more than $19 million for signal and communications improvements.

● **CN, CP: No small plans.** Then, there are the spending plans being worked on by the major Canadian roads. At this point, it would appear that CN Rail may rank first among North American roads in 1982, with CP Rail not far behind.

CN is budgeting $600 million in capital expenditures for next year, including $482.8 million for fixed plant. Roadway and terminals will get the bulk of CN's fixed-plant dollars, but there will also be $21 million for roadway machines, $12.2 million for shop improvements, $6 million for intermodal facilities and $3 million for signal and communications improvements.

CP Rail, meanwhile, is working on a budget that could run between $300 million and $400 million, depending upon whether CP gets a start on its Rogers Pass tunnel project in western Canada. It will also be spending heavily for track improvements, including installation of about 300 miles of continuous welded rail, insertion of about one million crossties and reballasting of about 300 miles of track. As for equipment, CP will be acquiring about 900 freight cars.

Those are the big roads. But they are by no means the only roads embarked on improvement programs.

Take, for instance, Chicago & North Western. This year, C&NW will spend about $251.4 million in capital improvements, divided $151.7 million for equipment and $99.7 for fixed plant. Next year, North Western drops down—to $123.2 million total, with $111.8 going for fixed plant improvements. That's going to provide 140 miles of 136-pound cwr, more than 600,000 new crossties, quite a bit of ballast, construction of new yard and connecting-track facilities, and installation of new etc and microwave. More than $11 million will go for new roadway machines and work equipment.

Roads with smaller spending plans? They may be smaller—but they're still significant, in terms of rail-industry improvement. For example:

—Kansas City Southern spent $64.2 million for capital improvements this year, $41.8 million of that for equipment (including 619 freight cars and a dozen locomotives). In '82, KCS will be laying out a bit under $24 million—no new equipment—but its spending for property-improvements will drop only slightly, to $19.8 million. Included in that budget will be $11.6 million for a variety of track improvement projects, $2.5 million for bridge and culvert work, more than $2.1 million for shop improvements and almost $2 million for signal improvements.

—Rio Grande's capital outlays were

modest this year, just $9.1 million. But in 1982, it will be spending $30.2 million, of which $27.3 million is earmarked for fixed-plant projects. Next year, Rio Grande will lay 65 miles of new rail and 28 miles of relay, make improvements to Moffat Tunnel, build new sidings and extend others, install additional power switches and hot-box detectors, improve its ctc system, and purchase additional roadway machines and other work equipment.

—Bangor & Aroostook, still an independent in New England, will spend $4.6 million on capital improvements in '82, less than half what it spent this year. For BAR the money will buy a new diesel-servicing facility, 10 miles of cwr and 15 miles of new crushed-rock ballast, 70,000 crossties, a new piggyback ramp at Presque Isle, Me., and the rebuilding of 100 boxcars in BAR's shop.

—Bessemer & Lake Erie will acquire more new freight cars in 1982 than some far larger roads. B&LE, which budgeted close to $11.7 million for capital improvements this year and acquired 484 cars, is budgeting almost $17.5 million for next year, with 752 freight cars on its shopping list. Spending for plant improvements will also be up.

—Elgin, Joliet & Eastern will hang in just about even, 1982 compared with 1981, with total capital expenditures of more than $14.7 million. Equipment will account for more than $13.5 million of the total.

—Duluth, Missabe & Iron Range expenditures will be up substantially, mostly for fixed plant. DM&IR will have a rail program under way, but the big item will be work on a shiploading facility that will cost almost $19 million.

—Katy, which budgeted $17.7 million for capital improvements in 1981, including more than $8.3 million for equipment, will spend $13.7 million in 1982, all for plant improvements. Included will be installation of 43 miles of new 115-pound cwr and almost 31 miles of relay 112/115-pound rail, and purchase of 38 machines of various types. As for Katy's proposed electrification project, "it's in the hands of our mechanical engineer. We have made feasibility studies, and the project is still moving forward. We still have to pin down finances."

● **Taxes—and traffic.** In looking at overall railroad capital-spending plans, short- and long-range, a couple of questions remain to be answered. One has to do with the impact of tax-law changes on budget-planning. The other has to do with the industry's response to an upturn in traffic.

On the tax issue, indications are that the 1981 changes will have more effect down the line than they will on specific '82 budgets. For example, the CSX railroads, Chessie System and Family Lines, say that tax-reform had little influence on planning for next year's programs—but that the "cumulative impact over a period of years is expected to be considerable." NW notes that "because of the faster depreciation allowed under the revised law, returns on investment on all capital projects are somewhat improved. This, of course, makes investment opportunities more attractive. However, it did not change the decisions made on any significant capital projects." Santa Fe says it recognized the availability of additional tax credits, "but they have not been a major factor in our final 1982 capital program."

Conrail, on the other hand, says that tax-law changes "have permitted a relatively larger capital program." And

Riding out the storm

If carloadings take a substantial upturn in 1982, so will railroad equipment budgets. Right now, neither eventuality seems likely.

Traffic prospects for most railroads are bleak for the first two quarters of 1982. A flat third quarter is expected with an upturn becoming evident by the fourth quarter.

That is the mid-December forecast of Richard E. Briggs, executive vice president of the Association of American Railroads. Briggs expects carloadings for calendar 1982 to be around 2% below 1981 levels, although revenue ton-miles could rise by 2% due to long, heavy hauls of coal and, perhaps, grain.

Briggs finds the railroads (if not their equipment suppliers) to be in good shape for riding out heavy economic weather. "We've been through two years of national recession and our earnings have not gone down—in fact, they've improved slightly," he points out. "I don't think you can expect to see a continued improvement, but our earnings have not taken the dive they have taken in past recessions. Our cash position is stronger. We have a plant that's in damn good shape as a result of heavy trackwork and an equipment fleet that's in excellent shape as a result of five years of high acquisitions and the elimination over the last two years of the worst of the fleet. In the past we got clobbered because of our fixed costs, and when we came out of a recession and business started to build up, our financial resources were very depleted. That's not true now, and I think that's the real strength of the industry."

● **"Alarming erosion."** But while a number of factors—greater pricing flexibility, benefits accruing from the 1981 tax law, a physical plant and an equipment fleet that are in excellent condition—all indicate that railroads will come out of this slump in relatively strong shape, Briggs does not minimize the seriousness of the current traffic picture.

"Traffic is getting softer—not so that anyone can recognize huge declines, but there's a perceptible and very alarming erosion of most commodities," he told *Railway Age* in a Dec. 17 interview. "Just compare the first 39 weeks of this year with where we are after 49 weeks. There have been some modest upturns in piggyback and 'other farm products,' and grain is coming back a little, but the rest of it is weakening. That's because the economy is weakening. I think that within a month we're going to hear about 9% unemployment; I'll give you an even money bet that you may hear about 10% before the situation gets better. Interest rates are coming down, but who is going to borrow money to invest in something that's not demanded? So I look for a continuing recession, going through at least the second quarter and with no large upturn in 1982."

Coal and grain could help cushion railroads against the full effects of the recession, becuase, notes Briggs, coal and grain movements are not necessarily tied to the national economy.

"We got through 1980 by living on coal and grain," he says. "In 1981, coal is up despite a 10-week strike that shut down half the industry. Grain for most of 1981 went to hell. It has now come back a little, but we had the worst fall harvest season we've ever had in terms of the movement of grain, and exports were terrible after the first quarter. If grain comes back in 1982—and there is no reason to believe that grain will move with the economy; if it goes in the same direction it's not for the same reasons—that could help temper some of the continuing declines in other products."

Briggs expects the railroads to close out 1981 with carloadings down about 4.5% from 1980 and ton-miles just about even.

● **From highway to rail.** As Briggs points out, piggyback is one of the few relatively bright spots in the traffic picture. Early in December, intermodal traffic was running about 2.6% ahead of 1980—and it's a trend that Harry D. Gobrecht, president of the National Industrial Traffic League (and vice president-transportation and physical distribution, U.S. Gypsum) expects to continue in 1982. His own company, whose traffic now moves 10% by rail, 90% by highway, will be using piggyback more than

North Western believes that the benefits flowing through from tax-law changes "will have a direct impact in increasing our capital spending sooner and by more," even though the '82 program was set before the revisions were approved and then declines in business forced a cutback in what was originally planned.

(Tax-law changes, it should be noted, are not limited to their effect on capital projects. As Missouri Pacific points out, the tax-reforms "particularly augur well for railroad research-and-development efforts...through a provision that gives a specific tax investment credit for rail R&D." Under the new law, any increase in R&D funding by an individual road over and above the level of spending during a three-year base period qualifies for tax credit. If the project is undertaken by the railroad's own people, the tax credit is 25% of the increased spending; if the work were assigned to an outside contractor, the credit would be at a lower level, 65% of the 25%. "Obviously," says MoPac, "the railroads have an excellent incentive to increase research funding. Some of this effort may be accomplished internally, but there will also be an opportunity for joint investment by several railroads or the entire industry for research projects.")

Then, there is the matter of railroad response to improved traffic levels—response that could see equipment builders' order books begin filling up once again.

The huge numbers of locomotives and freight cars in storage constitute an inventory that will have to be worked off before there is an absolute need for additional new equipment. On the other hand, several roads indicate that they do see demand for additional specialized equipment. And, the industry has been retiring old equipment at an increasing rate: AAR figures show that in the 12 months ended Sept. 30, railroads and railroad-owned/controlled car lines retired more than 82,000 cars, about 7,200 more than were taken out of service in the preceding 12-month period.

As for the specifics on the likelihood of upward adjustment of budgets: Conrail says it has an adequate supply "of most types of equipment to meet current and projected demand. However, a sharp upturn in the economy would cause CR to re-evaluate its equipment-acquisition program." That kind of upturn would probably increase investment by such roads as Rio Grande and KCS in equipment, by KCS in additional track improvements, by Southern Pacific in the area of major facility improvements, by the CSX railroads for acquisition of more locomotives. And for a number of roads, large and small, traffic increases would, predictably, bring further increases in already-increased maintenance budgets.

What these capital and maintenance budget numbers seem to point to is a 1982 in which some parts of the beleaguered railway supply industry will fare better than others, in view of the higher numbers railroads are putting into fixed-plant improvement and the lower numbers being attached to equipment spending. At the same time, bigger budgets for both equipment and plant maintenance—even if you deduct an arbitrary 50% for the labor-expense factor—should produce additional business for a wide range of suppliers, including those in the hard-hit freight-car-component business (ironically, a business in which several major suppliers have invested heavily to increase production only to see railroads cut back sharply on purchases this year.) ■

Carloadings, 49 weeks

Commodity	1981	% change from 1980
Grain	1,287,796	−13.8
Farm products ex. grain	210,343	− 4.7
Metallic ores	1,544,179	+10.9
Coal	5,433,662	+ 0.8
Crushed stone, gravel & sand	597,828	−13.2
Nonmetallic minerals	645,793	−11.8
Grain mill products	703,134	−15.6
Food & kindred products	764,293	−13.3
Primary forest products	898,401	− 5.8
Lumber & wood products ex. furniture	381,147	−14.6
Pulp, paper & allied products	948,164	− 5.8
Chemicals & allied products	1,286,012	− 3.3
Petroleum products	255,053	− 9.3
Stone, clay & glass products	665,008	−11.8
Coke	315,238	+21.1
Metals & products ex. coke	763,177	− 1.9
Motor vehicles & equipment	778,458	− 3.7
Waste & scrap materials	584,365	− 2.1
Forwarder & shipper assn. traffic	469,553	−10.9
All other carloads	2,027,122	+ 0.3
LCL Traffic (cars)	11,291	+ 2.9
Piggyback (48 weeks)	1,580,862	+ 2.6

in the past, he says.

"That will result first of all from having reliable service, which we are seeing more and more of," says Gobrecht. Contributing to better service, he notes, have been express trains such as Milwaukee Road's "Sprint" and Illinois Central Gulf's "Slingshot". "But just as important," he says, "where railroads are taking traffic from trucks they have priced their TOFC service below truck rates."

Gobrecht applauds railroads that have extended pickup and delivery service under Plan II (rail-owned trailers), at the same time offering competitive rates. "We never were able successfully to use Plan II because pickup and delivery was largely restricted to terminal areas. Now some railroads are virtually going everywhere, and we're able to use it."

One reason for improved piggyback service has been deregulation—and Gobrecht sees deregulation as helping railroads become generally more competitive. "My company has seen an almost revolutionary change in the attitudes and approaches of railroad marketing officials," he says. "The emphasis is changing rapidly from production-oriented to marketing-oriented. We're seeing examples of this every day."

Gobrecht also sees other promising trends: New emphasis on recapturing traffic lost to competitive modes rather than to other railroads; short-term rates as incentives to move traffic immediately; reduced rates for shippers in return for increased volume; contract offerings including higher rates for guaranteed, faster or improved service, and lower rates for some types of new business; use of cars assigned to shippers for backhauls; and greater overall service reliability.

Most shippers want to see railroads do even more with their new freedoms. Says one big eastern shipper whose business is now divided almot evenly between railroads and highways: "We'll be offering fewer loads in the next few months—and those will go to the carrier that can give us service *plus* rates that will help us keep our own costs under control during these difficult times."

Freight brakes for the '80s

By JOHN ARMSTRONG,
Associate Editor

"There's one thing that selling to the railroads develops," comments an air brake executive in reviewing today's and tomorrow's prospects in the evolution of the hardware that will keep freight trains in check.

"Patience."

Indeed, the pace of innovation out on the road can seem glacial, and there are often more solutions than there are problems which can afford them. You have to look at the situation over the long pull (Fig. 1) to get some feel for today's rate of reequipping of the fleet in comparison with what has gone on before. On the same scale, of course, the dieselization of North American railroads in the late '40s and early '50s would look almost like a step function. Is a 20-25 year period "normal" for expanding usage of a new generation of brake valve to encompass the fleet, or has someone perennially dropped the ball in taking advantage of new technology? Right now, is freight braking progress likely to keep up with the needs of the decade or will it be a major bottleneck in the efficient movement of the continent's freight?

Much if not most of the responsibility for the past, present and prospective rate of change in freight braking technology comes from the philosophy, dating from the Master Car Builders standards of 1887, that new systems or components must interchange freely with (and, if anything, enhance the overall performance of) their predecessors as they are introduced, car by car, in the general-service pool. Does this idea still work or is it unaffordably incompatible with everything from new work rules, service demands, and such technical possibilities as microprocessors?

Well, for one thing you can say immediately that it at least calms things down to the extent that it's possible to have some idea of what's going on. Passenger-train and rapid-transit braking, largely freed from "interchange" standardization requirements and with electrical power available, now represent such a thicket of possibilities and implementations that suppliers in the field are hard put to keep track of even their own developments and product lines as difficult customers select, assemble, and tinker with individualistic solutions.

● **Some things won't change.** A thoughtful review of prospects for the next decade was presented by WABCO's David G. Blaine, MoPac's Mark Hengel and WABCO Canada's Harvey Peterson in a recent ASME paper putting train brake requirements in terms of handling projected tonnages within available track capacity. *(Train Brake and Track Capacity Requirements for the '80s, ASME 81-RT-11.)* The 1990 freight train, it predicts, must be at least as long as today's (and heavier, since most cars will be 100-tonners by then) simply because most routes will remain single track and there is no other way to move the tonnage other than by handling it in massive consists moving from siding to siding under the protection of block signaling spaced to match train stopping characteristics.

Foreseeing no change in maximum allowable speeds as codified by Federal law, this analysis assumes 40 to 60 mph over the road running by most trains, perhaps with some expedited 70-79 mph trains of lesser tonnage mixed in to meet service requirements warranting the higher fuel consumption.

Fleet size is seen as expanding moderately with up to about 20% improvement in utilization despite the fact that general-service cars will continue to spend a lot of time in yards. With general acceptance of the idea that 263,000 pounds on four axles will remain as a practical limit, "100 ton" car design is seen as continuing to work in the direction of more and more lading, less and less tare (to as low as 40,000 pounds) within the same gross.

● **The ABDW can hack it.** A reasonable projection shows 50% of the fleet equipped with ABDW brake control valves by 1990 since all cars ordered after Jan. 1, 1977, have been so equipped. With its accelerated service application function using serial action to speed up brake pipe reductions and brake cylinder pressure build up throughout long consists, the ABDW will maintain the same stopping distance (Fig. 2) with 12% to 30% longer *or* 12% to 30% heavier (average tonnage per car) consists at the same road speeds and with similar train dynamics. With intermixed ABDW's enhancing overall train performance proportionally, track capacity will in effect grow steadily during the changeover period, for routes over which most traffic moves in consists of cars of varied vintage and lading.

So, at least in theory, the current standard braking system should manage to keep up with demand—though with little margin. Fuel cost considerations will tend to favor making use of the enhanced braking capacity by lengthening rather than speeding up trains, putting downward pressure on overall car utilization. Is this all that's going on in the braking business to prevent a possible crunch if things don't work out almost precisely as calculated?

● **Keeping them out of the shop.** Car utilization is also a matter of keeping them on the road and away from the shop or rip track. On the basis of a 13-railroad survey reported in the ASME paper, air brakes and related equipment led all categories of repair in frequency, accounting for 20% of the total; wheelset work—some of which is also related to brake performance—is involved in 15.5% of repair incidents. The money involved in brake work (Table I) is likewise impressive. Longer-lived brake shoes are obviously important.

Among the other categories, a significant shift has occurred as the scheduled COT&S interval for brake valves has been lengthened from the 12-month standard maintained over the first 60 years or so of the power-brake era. Diaphragms, O-rings and spool valves replacing piston ring and slide valve designs in the AC/ABD evolution of the 1950's have led to its extension to the present 16-year standard for ABD and ABDW systems and to 96 months for AB's. With such guinea-pig car sets of the current technology as the 200 on the Norfolk & Western still going strong after an even longer history, it's considered likely that time-interval COT&S itself will phase out with the older valves in the near future.

Confirming valve reliability over these long periods of time is the in-date testing program in effect for about 30 years which requires that every car undergoing repairs of any kind receive a full single-car air brake test if it has been over 90 days since its previous stenciled IDT or COT date.

Current IDT results reported are illuminating:

—Moderate to high utilization cars receive an IDT about twice a year on the average. About 95% pass.

—About 95% of the IDT failures are for leakage in the brake piping, fittings, hoses or angle cocks.

—Most of the remaining failures are represented by brake cylinder or valve leakage. Foreign material ingested is responsible for the majority of vent valve problems; this in turn is attributed to uncoupled brake hoses dragged through piles of lading, since corn kernels, wood chips, plastic pellets and other light fragments are the principal items found jamming the works.

—Only about 1% of cars failing IDT have identifiable internal valve deficiencies.

With the present mix of AB, ABD and ABDW valves in service the reported

Figure 1
Freight brake evolution — 1890-2000 A.D.

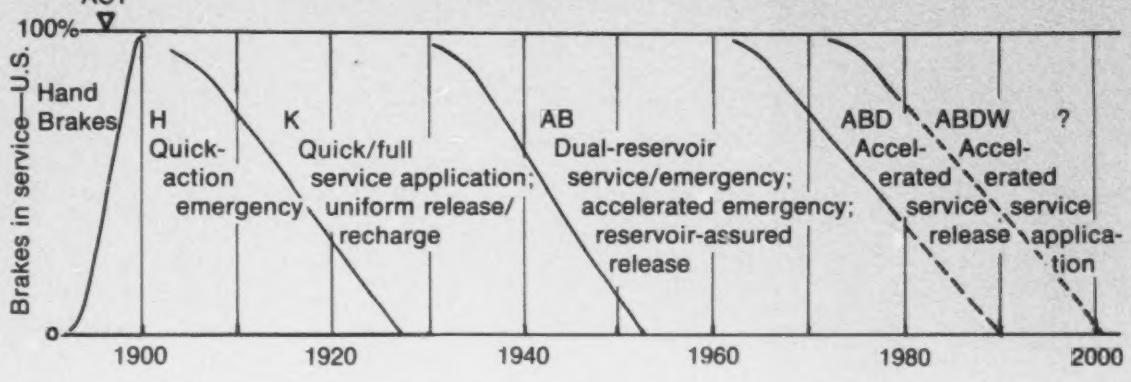
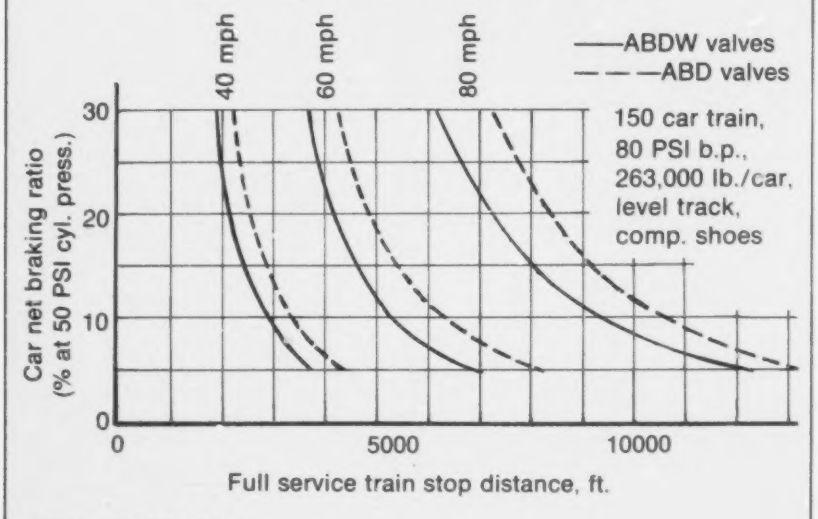


Figure 2
ABDW vs ABD stop distances



Data source: ASME 81-RT-11

rate at which cars have to be cleaned because of inoperative brakes averages from 1.8% to 2.2% per year, "indicating a nominal product life of about 25 years." Considered prime candidates for major improvement are the mundane but expensively vulnerable end-of-car hardware items; long-overhang cars with their long-shank couplers need a solution to the problem—"as yet practically unsolved"—of coupler pass-by during attempted yard couplings.

● **Improving on perfection.** In the design and manufacture of the most complex portions of the system there's a new kid on the block. With conditional AAR approval for up to 7,500 car sets in interchange service, Britain's Westinghouse Brake and Signal Co. (itself now a Hawker-Siddeley subsidiary) has entered the North American market with its new Westcode, Inc. plant in Frazer, Pa. Its entry: the Z1AW brake valve, an alodined-aluminum-alloy unit fully interchangeable with the basically cast-iron ABDW valves made by New York Air Brake and WABCO.

Westinghouse Brake & Signal's development of long-life, low-maintenance brake components for European service in the 1950's took a somewhat different path. As in the North American systems, slide valves and piston rings went out, but for the P4A graduated-release control valve the U.K. design went in the direction of soft-seat poppet valves and flat diaphragms instead of spool valves. Permanent-mold and die castings, bypassing the problem of keeping core sand out of the finished product, also were adopted. As in the case of the ABD's and successors, improved performance via smaller and more reproducible actuating-pressure differentials figured in the new valves.

Getting into the American market is no casual matter (Westcode has a 150-car test rack at its new plant, built in support of the process of securing approval for service), even though unmachined castings and some other parts are purchased rather than made from scratch in-house. Westcode's Z1AW is 49 pounds lighter than its counterparts—no huge deal right now, perhaps, but a step in the right direction (along with aluminum alloy reservoirs, now in experimental service) in anticipation of increasing interest in weight saving in every component as pressure for low-tare cars heats up. Conceding that the difference between a valve that will last 20 or 25 years (or whatever the life of an ABDW actually is) and one that by all indications will last even longer may be rather academic, Westcode sees manufacturing, lubrication stability, precision performance and other benefits of its design principles sufficient to make its entry a tough competitor over the long pull. Catching the U.S. market at the low, low point of its cycle was not exactly part of the game plan, of course, but Westcode (now set up to do all new development work for the American market, including such items as a light-weight relay valve, at the new plant) has never considered the new venture to be a short-term proposition.

● **Is air quick enough?** Does a system which takes 13 seconds to begin to apply braking pressure to the 150th car of a train and 70 seconds to reach full service pressure—as the ABDW does under typical conditions—seem incompatibly slow with present operational requirements when electricity has been around for so long? Slack control is a primary concern in the very complex business of track-train dynamics; electro-pneumatic brakes have a long history on passenger trains—particularly in European practice; and elaborate digital techniques for

verifying and responding to the status of wire, inductive or radio communication/control links are duck soup with microprocessors and all those other good solid-state things.

Most telling of seven classes of obstacles cited as facing widespread, cost-effective application of simultaneous braking on freight trains of American length and tonnage is probably the fact that (to borrow signaling terms) train braking must be a *vital* function, with energy sufficient to stop the train present throughout the consist before it is allowed to proceed. "While it is possible to make an electric or electronic brake vital, circuit continuity and attenuation problems would make it very difficult to get trains out of the yard and to reliably continue over the road. Any electric or electronic brake requires an automatic air brake back-up system to be at least as reliable as the present AB-ABD-ABDW brake," is the way ASME 81-RT-11 puts it.

As if to emphasize the matter, the current decade started off with two of the most spectacular and costly runaway accidents in history. Neither represented a failure of today's braking systems if maintained, tested and operated strictly by the book to keep train speed within limits, but gravity's capabilities in generating enough energy to total an entire 80-car consist and in accelerating loaded cars to 118 mph were vividly reaffirmed. The muscle for stopping, come what may, must be on the cars, and in practice that means compessed air. But what price is paid for less than instant response?

FRA reportable damage totals for brake-related train accidents (Table II) set some bounds on the problem. Actual costs of these accidents are higher than indicated, since only damage to railroad equipment and roadway is included, and such effects as flat wheels resulting from undesired emergency applications where everything stays on the track and less than the threshold damage ($2,900 in 1980) for classification as a train accident is incurred don't show up at all.

Nevertheless, it's apparent from these figures that *over-the-road braking-dynamics deficiencies* are not one of the principal items of accident damage. Considering that the "interaction of lateral/vertical forces" catchall includes tractive force application problems as well as braking reactions and *their* interactions, a fair guess might be that 2% to 3% of all train-accident damage is attributable to this factor. The relative importance of making sure that nobody skimps on setting handbrakes is striking.

Much of the complexity of today's brake valves arises from the service-demonstrated necessity to control the rate of transmission, charging, application, release, venting and other functions, often in two or more stages, through ingenious and subtle tinkering with volumes and orifices. Increasingly, the satisfactory handling of long trains over difficult undulating or steep profiles depends on putting the insights developed by computerized train-dynamics analysis into procedures, instructions and training programs that govern the way the locomotive engineer handles his handles. Overall, the job does get done, with hardware that is expensive but affordable, complex but increasingly maintainable, imperfect but certainly usable.

Table 1
Major brake component AAR repair billings

ITEM	No./Car/Yr.	$ Charges/Yr. $/Car	$ Charges/Yr. Fleet total $
Brake shoe/key replacement	11.60	$156.96	$266,800,000
In-date test (IDT&S)	1.08	31.87	54,200,000
End & intermediate hoses	.74	15.77	26,800,000
Brake beams & rigging	.25	15.54	26,400,000
Clean, oil, test (COT&S)	.14	7.82	13,200,000
Hand brakes, bell cranks	.08	5.37	9,100,000
Release, relay, vent valve repl.	.07	4.59	7,800,000
Valve portion, reservoir, etc., repl.	.07	4.21	7,200,000
Angle cock replacement	.12	3.49	5,900,000
Automatic slack adjuster repl.	.014	2.96	5,030,000
Total brake system		**$253.53**	**$431,000,000**

Data from ASME 81-RT-11
Fleet total billings based on 1,700,000 cars

Table II
Brake-related train accidents & reportable damage 1980

	Accidents	Damage
Mechanical Failures		
Rigging down or dragging	56	$1,774,000
Air hose uncoupled or burst	29	1,070,000
Brake pipe or connections	11	780,000
Undesired emergency application	6	455,000
All other brake components — car	18	340,000
All other brake failures	67	1,079,000
Total, brake	**187**	**5,498,000**
Human factors		
Non-/Misuse of handbrake	265	6,760,000
Improper use - automatic air brake	20	965,000
Improper use - independent air brake	22	510,000
Improper use - dynamic brake	6	245,000
All other brake usage	30	867,000
Total, use of brakes	**343**	**9,347,000**
Miscellaneous		
Interaction of lateral/vertical forces (including all causes - power, braking & combinations)	162	7,283,000
Emergency brake: appl. to avoid accident	15	439,000

Data from FRA accident/incident Bulletin No. 149
Total train accidents from all causes = 8451
Total reportable damage (roadway & equipment) = $273,905,000

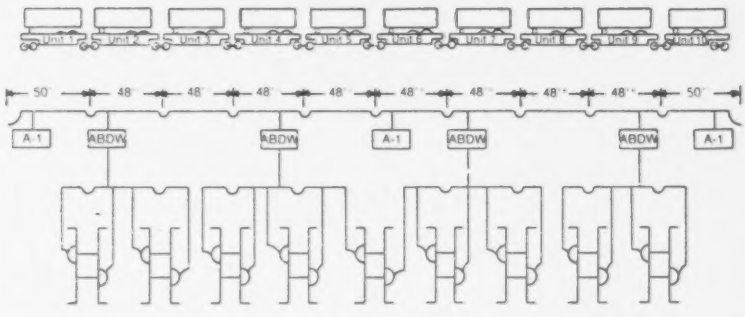
● **Empty and load—again...and again.** A narrow-gauge electric railroad that carried swarms of passengers around the ground of the World's Columbian Exposition in Chicago in 1893 had an empty/

load braking system which used two cylinders to vary shoe forces in accordance with the status of each car's patronage. Manually-set KDEL empty/load braking for freight equipment became available in the 1910 era. By 1925 this was superseded by a system which was set manually to activate the second (load) brake cylinder but automatically returned to the empty braking level.

In 1980, 96% of all cars in a sampling of typical freight consists had brakes which apply the same retarding force to their wheels whether they are loaded to the limit or empty. Clearly, empty/load braking has had a great future for over eight decades. Must it continue to have a great future on into eternity?

The physics is simple—cars in a train braked at different ratios will slow down at correspondingly different rates until they run into each other and reach some sort of compromise. AAR standards and recommended practices call for a minimum braking ratio (composition shoes) of 6.5% of gross rail load (GRL) at the 50 psi cylinder pressure which represents full service braking with the minimum legal brake-pipe charging pressure of 70 psi. As Fig. 2 illustrates, stopping distances increase rapidly as braking ratios for a whole train get down into this range.

Figure 3
Truck-mounted brake assemblies



*Approximate brake pipe length

It takes 4% to 5% of additional braking ratio to balance the effect of a 2% descending grade.

On the other end of the spectrum, empty-car braking ratios are restricted to 30% under the same conditions to prevent excessive uncertainties of wheel sliding under emergency braking at typical speeds and brake pipe pressures.

The effect of these limits is to require that a 100-ton capacity car (263,000 GRL) with a light weight less 6.5/30ths of that (57,000 pounds) must be equipped with empty/load braking, and that good a tare weight ratio is being achieved by more and more cars as the economics and technology of car design push in that direction.

How much of a problem is this fancier braking? Thirty or 40 years ago when relatively light weight 90-ton cars began to appear, the required braking force did strain shoes and rigging, and considerable numbers of cars were E/L braked with relatively complex two-cylinder or dual-diameter-cylinder systems. By now these could feel truck spring deflection well enough to set themselves as cars were loaded and unloaded.

Development of high-friction composition brake shoes which provided better speed vs. friction characteristics as well as doing the job with lower piston and rigging forces made it possible to meet the conditions of the time without the E/L gear, and off it came in a good many cases.

What's the prognosis now?

● **More and better choices.** The brake people have been busy, providing a choice of ways of doing the job at price differentials (compared with single-level braking) representing a considerably lower fraction of brake system or car cost than the dual-cylinder systems of the previous go-around.

—American SAB manufactures an adaptation of an adjustable-leverage system which has been in use in Europe for over 20 years and is found on about 1,500,000 cars there. Air tapped from the emergency reservoir flows through an on-truck change-over valve (if spring deflection indicates that the car is loaded) to an empty-load box; this disconnects a fulcrum rod in the foundation rigging which serves in the empty car as the pivot determining the braking ratio. This in turn allows an alternate fulcrum rod to take over, increasing the braking force in accordance with the geometry determined by the lever proportions. Some 2,000 car sets are in service on this side of the ocean under AAR conditional approval; it's a relatively simple, proven system but not adaptable to truck-mounted braking or readily standardized for widespread American application.

—Ellcon-National's 6200-Series fixed-displacement empty-load system uses the weight of the lading in a bulk-commodity car to close a valve which shuts off a chamber normally connected directly to the brake cylinder; the resulting increase in cylinder pressure corresponding to a given brake pipe reduction correspondingly increases effective braking force when the car is loaded. Several thousand are in service, also under AAR conditional approval. The Ellcon-National 4900-Series system is a more elaborate (and less widely used) unit in which truck spring deflection decreases the chamber volume proportionally, providing braking power varying between empty and load-limit ratios if the car is loaded with commodities of different density.

—WABCO and New York Air Brake supply the standardized SC-1 empty-load system, developed in the early 1970's. On a loaded car, full brake cylinder pressure is developed; when the car is empty, reduced truck spring deflection is sensed

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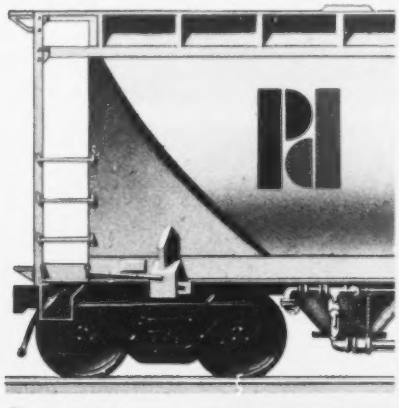

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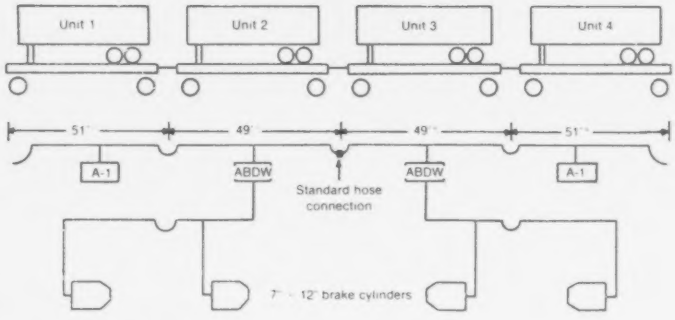
Figure 4
Foundation rigging



*Approximate brake pipe length

by an arm on a sensor valve which activates a proportional valve which regulates brake cylinder pressure to a fixed percentage (usually 60%) of that called for by the brake valve system. Universally applicable in well-standardized form but somewhat more complex, the SC-1 system currently adds about $415 to the price of a car.

● **Is 6½% enough?** The 6½% loaded/30% empty standard allows most general-service cars to go into interchange without empty/load braking, and that's exactly what most of them have been doing. Improved train handling which would result from having more uniform response throughout mixed consists is an ideal which isn't often perceived as bringing tangible benefits to the car owner matching the extra cost.

In unit train service where all cars in a train are either empty or loaded, the matter of uniform response doesn't arise, and some of the effect of empty/load brakes can be achieved by varying the brake pipe pressure. In this service a railroad's attitude tends to vary quite predictably with its terrain. Lowering a train down a long grade with an adequate reserve of service braking (usually considered 100% above that required to "balance the grade" with air brakes alone) to be able to bring the train to a stop in a satisfactory distance quickly passes the limit of 6½% braking ratio as the grade steepens; at 2.0%, this margin requires an average braking ratio of 9.0%, at 3.0%, 15% under typical curvature conditions. For loaded unit trains, with no empties or light loads to bring down the average tons per operative brake, the situation is not at all academic.

Confronted with the uniquely extreme situation of bringing tonnage down the 4.7% of Saluda (N.C.) grade safely, Southern looked at requirements carefully and decided as a matter of policy that it must aim for at least 9% net braking ratio (calculated at the standard 50 psi brake cylinder pressure) for all its equipment. As a result, it has been buying empty/load braking for all its 100-ton and heavier cars (some are loaded to 286,000 pounds GRL); in Canada, Canadian Pacific is also leading the way toward standard braking levels in this range in deference to its long descending grades now carrying line-saturating tonnages of bulk coal, grain, potash and sulfur.

How *does* Southern get a train down Saluda? Its brake pipe charged to 100 psi, all retainers set up and all brakes operative, a carefully orchestrated cycling of automatic air, dynamic and independent braking (initiated immediately as the train eases onto the grade) keeps speed from rising above the 12 mph at which there is still assured reservoir capacity and charge for an emergency stop.

With 100-ton capacity cars (typically those types carrying commodities which load to the full GRL limit) becoming a majority in the North American fleet well before 1990, there is growing belief in the air brake community that net braking levels must rise, probably to 8% at the 50 psi reference. This will in turn require empty/load equipment for all light weights up to 70,100 pounds for the 100-tonners and 58,700 pounds for the remaining 70-ton (220,000-pound GRL) cars. Since many of the 70-ton cars are those whose lading loads to cube rather than weight, an alternative suggestion would leave their minimum braking ratio at 6.5% of the nominal GRL; the overall effect in a mixed consist with the empty/load braked 100-ton cars could be somewhat more uniform.

In any event, some change in ratio will occur. *When* remains a good question.

● **Still burning up wheels?** Isn't it archaic to expect those ever more heavily burdened wheels to serve as brake drums? Maybe—until you look at the alternative. The freight car center sill has effectively pre-empted the territory which would be needed for braking discs and caliper rigging of adequate thermal capacity. From a practical standpoint, braking is going to continue to help wear out most freight car wheels.

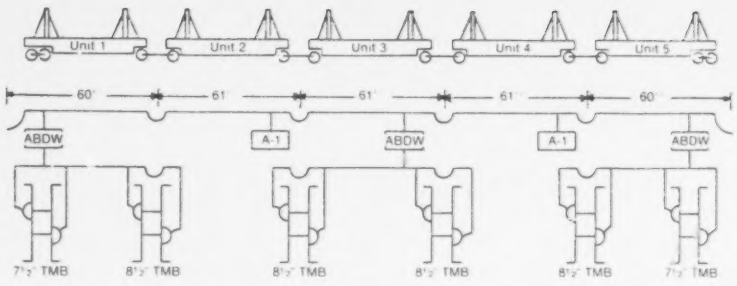
The sensitivity of railroad preferences to fairly small cost differentials and trade-offs is evident in the continuing saga of truck-mounted brake cylinders vs. the standard "foundation rigging" with its single body-mounted cylinder and collection of links and levers. The WABCOPAC and NYCOPAC systems have been around for twenty years, long enough to establish that the better balanced application of force to their brake beams does reduce wheel wear significantly. For low-slung cars where foundation rigging is impractical they're a must; for other applications the option is open, with some cost differential (hard to pin down precisely, since extra brake equipment quotations are accompanied by reduced carbody component and installation costs, but in the $100-200 per car range) in favor of the body-mounted rigging. Current installations are running about 12-15% truck-mounted, with those railroads that expect their cars to spend enough time in the braking mode on long grades to pay back the differential in wheel-wear savings going for the truck-mounted brakes—if necessary accepting in turn some additional complication in providing hand-brake rigging at both ends of the car to meet desired braking levels in that respect.

If the dominant car in 1990 is still going to be a 263,000-pound eight-wheeler with a hose sticking out each end and shoes rubbing on its wheels when an ABDW-type valve so directs, the ferment in special-purpose car design is sufficient to suggest that a lot of cars and trains—particularly in intermodal service—will have departed considerably from that norm. Both articulated and single-axle-truck cars are coming on line in numbers that go well beyond the experimental. Is this going to be a problem for brake-system designers?

A recent Air Brake Association paper by WABCO's Harry Weber and John Novotny suggests that it's more of an opportunity for clever adaptation than a crisis. The essential parts are there (as, given the railroads' demonstrated dislike for anything not already in the logistic pipeline, they'd better be) and it's up to the designer to find ways to put them together to do the job, which is complicated principally by a few considerations:

—Articulated cars typically carry almost twice as much weight on their mid-car trucks as on each end truck. This may require a proportioning valve if

Figure 5



*Approximate brake pipe length

some arrangement of standard cylinder sizes won't provide braking force distribution to match.

—Obtaining the weight reduction and overall equipment simplification benefits that come from reducing the number of trucks to carry the load may result in long brake-pipe spans between control valves.

—Running hand-brake connections across "joints" between car units is messy.

Air brake engineers have become used to thinking in terms of brake pipe length rather than simply numbers of freight cars ever since the very long piggyback, hi-cube and rack cars entered the picture, so a variety of vent and reduction relays valves have been developed which in effect make long cars respond to service and emergency brake signals in a fashion equivalent to that of a similar-length string of 50-footers. For the new-era combinations, it's a matter of following the rules.

Fig. 3 shows how the longest current assemblage of units, the Santa Fe 10-unit "Fuel Foiler," is braked. Note that there is no power braking on the two end trucks; the AAR required net braking ratio can be met without retardation applied to these lightly-loaded trucks, thus eliminating the need for proportioning valves.

Trailer-Train's 4-Runner cars use the arrangement shown on Fig. 4. Foundation rigging on each unit is actuated by a single 7-inch cylinder so no brake connections need cross between units; to the ABDW valves, the two 7-inch cylinders look like a single standard 10-inch cylinder. The Southern Pacific/ACF "Double-Stack" container car uses the arrangement of Fig. 5. Mixing standard 8½-inch and 7½-inch cylinders stays within braking level limits for the overall car and for both end and inboard trucks without the use of proportioning valves in the case of this five-unit car.

● **Winter fun and games.** Should articulated or other multi-unit car concepts become a major part of the fleet, additional advantages beyond weight reduction can be expected, including slack reduction and—as Duluth, Missabe & Iron Range's "Mini-Quad" aggregations of four permanently-coupled ore cars have been demonstrating for ten years—reduced brake pipe leakage allowing unimpeded full-train operation throughout the cold season.

The requirement of welded brake pipe assemblies which went into effect in 1972 is generally agreed to have done wonders in effecting steady improvement in brake system performance; nibbling away at the overall problem of maintaining operations in bad weather has taken many forms, including improvements in the single-car test requirements and procedures.

Can measuring the rate of air flow into the brake pipe necessary to maintain its pressure be used (in addition to the existing 15 psi limitation on overall pressure gradient between engine and rear car) instead of the "5 psi per minute leakage" criterion to qualify a train for leaving its terminal? This procedure, which particularly expedites establishing the length of consist which can be handled with pressure-maintaining brake equipment in extreme weather, has been under test for three years in Canada—to the extent of over a million initial and intermediate terminal tests. Tests on the Soo Line and Duluth, Winnipeg & Pacific under FRA/AAR waiver are beginning in the United States. This "Air Flow Method," which uses the air flow meter on the locomotive control stand already in long use on many railroads, also monitors any change in the brake pipe leakage occurring during the run. Will it become standard? Quite possibly, but not for a while yet. ■

Guilt by association: Catching dynamiters

A long-time problem in railroading is the "dynamiter"—a car whose brake valve for some reason goes into emergency during a service application and brings the train anonymously to a sometimes damaging or even catastrophic (and always delaying) halt. With modern electronic timing and pressure-sensing instrumentation it has been demonstrated that calculations from the time of arrival of the shock wave in the brake pipe at the ends of the train can determine the point of origin of the emergency application well within one car length, nailing the culprit. A prototype system based on Southern Pacific work some years ago has been built and three more units for service testing authorized; a system working on the same phenomenon has been developed at the Transportation Test Center and is in use on the FAST train at Pueblo.

Elsewhere, finding the dynamiter in a consist brought to a halt by an emergency application arising from no evident cause (a burst or disconnected airhose, for example) has been a matter of repeated brake tests on divided portions of the train, with Murphy's Law dictating that the last car tested will turn out to be the villain.

To improve the odds using available computer and communication capabilities, SP established a UDE (undesired emergency) Repeater program working within its TOPS system. Whenever an emergency application with no identifiable source occurs, *all* cars in the consist are entered from TOPS into the UDE Repeater program's memory. Any individual car that shows up for the fourth time will have its air system cleaned and all valves rack-tested. Experience has indicated that 80% of four-time repeaters did in fact have some problems, either failing rack tests or showing some anomalies on tear-down inspection that could cause a UDE on occasion, although most had passed single-car tests.

When a train experiences a UDE, any of SP's numerous TOPs-equipped terminals can immediately obtain the UDE history of every car in its consist; in about 60% of the cases, the offender has been found within the list of cars with some previous association with the problem and the search has been immediately narrowed.

The UDE Repeater program also spotlighted a particular series of cars which upon examination turned out to have incorrectly drilled vent-valve orifices (from a systematic error in a contract-overhaul program); a related SP program accumulating data on air hose separations located particular long-car hose support arrangements which were prime offenders, leading to a modification/inspection program reducing the incidence of such events.

Market

CARLOADINGS

Loadings of revenue freight in the week ended Dec. 5 totaled 396,173 cars, according to the Association of American Railroads. This was a decrease of 51,598 cars, or 11.5%, compared with the corresponding week last year, but 19.0% higher than the preceding Thanksgiving Day week of this year. Ton-miles generated by carloadings in the week ended Dec. 5 are estimated at 17.1 billion, a decrease of 10.2% below the corresponding week of 1980.

REVENUE FREIGHT CARLOADINGS

Commodity	Dec. 5 week	Nov. 28 week
Grain	25,231	21,722
Other farm products	5,344	5,246
Metallic ores	26,075	18,632
Coal	121,701	105,940
Crushed stone, gravel & sand	9,981	7,507
Nonmetallic minerals	10,941	7,175
Grain mill products	12,456	11,103
Food & kindred products	14,449	12,564
Primary forest products	17,773	12,667
Lumber & wood products (except furniture)	5,853	4,518
Pulp, paper & allied products	18,642	17,182
Chemicals & allied products	23,234	20,112
Petroleum products	5,240	4,441
Stone, clay & glass products	10,998	9,193
Coke	6,136	5,269
Metals & products	12,154	10,512
Motor vehicles & equipment	13,012	10,512
Waste & scrap materials	9,280	7,630
Forwarder & shipper assn. traffic	8,363	7,467
All other carloads	39,125	33,248
LCL traffic	185	162
Total Cars Loaded	**396,173**	**332,802**
Cumulative total, 49 weeks	**20,570,017**	**21,406,539**
Estimated revenue ton-miles (billions), 49 weeks	**869.7**	**868.0**

PIGGYBACK LOADINGS

U.S. piggyback loadings for the week ended Nov. 28 totaled 27,998 cars (4.8% above the corresponding 1980 week) and 50,969 trailers or containers (up 6.8% from 1980). Cumulative volume for the first 48 weeks of 1981 is 1,580,862 cars (up 2.6% from 1980) and 2,871,712 trailers or containers (up 2.7% from 1980).

CANADIAN CARLOADINGS

Canadian railway revenue freight loaded in the seven-day period ended Nov. 21 totaled 5.4 million tons (up 2.4% from 1980). Cars loaded totaled 75,015 (down 3.3% from 1980). Cumulative loadings for 1981 were up 227.4 million tons (down 3.6% from 1980).

● *Bangladesh.*—Awarded contracts worth $17.5 million to Bombardier-MLW for the supply of 12 new 2,400-hp diesel-electrics and the refurbishing of seven existing units.

● *CP Rail.*—Ordered 300 track miles of rail valued at $40 million from Algoma Steel Corp. Approximately 81,000 39-foot lengths of rail will be joined into quarter-mile-long sections of cwr at CP's welding plants at Transcona, Man., and Smith Falls, Ont., for installation throughout the system in 1982.

● *Central Louisiana Electric Co.*—Awarded a five-year contract to PLM Railcar Maintenance Co. for the maintenance of 253 unit train coal cars at PLM's Alliance, Neb., facility.

● *General Railway Signal.*—Awarded a $525,150 contract to Infrared Industries of Waltham, Mass., for the manufacture of Infratron Radiometers, detection devices that are used as part of GRS's Wheel Thermo-Scanner units.

● *Minnesota DOT.*—Awarded a contract to Exide Industrial Battery Division of ESB, Inc., for supply of a photovoltaic solar energy cell and lead acid storage battery for Minnesota's first solar-powered crossing signals (*RA*, Nov. 30, p. 4).

● *New Jersey Department of Transportation.*—Awarded a $30.4-million contract to a joint venture of The L.E. Myers Co. and L.K. Comstock & Company Inc. for conversion, extension and rehabilitation of electrified Erie Lakawanna rail lines in northern New Jersey. Contract covers lines between Summit and West End, near Hoboken, N.J., the final section to be awarded in the conversion from 3,000 volt DC to 27.6 KV AC. Starting next spring, work will be completed by December 1982.

● *Pakistan Railways.*—Placed a $27.8-million order with the Rail and Diesel Products Division of Bombardier for the rebuilding and upgrading of 42 diesel-electric locomotives. Bombardier is to supply 24 complete engines, rebuild components and technical support services. Shipments of the first rebuild kits from Montreal to Pakistan, where the locomotives will be rebuilt by local labor, will start within one year. Bombardier previously assisted Pakistan in the rebuilding of 51 locomotives.